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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/772,510	MICHELSSON, DETLEF	
	Examiner	Art Unit	
	Katrina Fujita	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 June 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *3-16 and 27-34* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *3-16 and 27-34* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. This Office Action is responsive to Applicant's remarks received on June 05, 2007. Claims 3-16 and newly added 27-34 are pending.

Drawings

2. The previous drawing objection has been withdrawn in light of Applicant's amendment.

Specification

3. The previous specification objections have been withdrawn in light of Applicant's amendment.

Claim Suggestions

4. In claim 27, line 5, "dividing the SAW in a plurality of logical SAW segments" should be changed to -- dividing the SAW into a plurality of logical SAW segments --.

5. In claim 27, line 15, "image flied' should be changed to -- image field --.

6. In claim 28, line 15, "image flied' should be changed to -- image field --.

7. In claim 32, line 1, "acquire a macroscopic images" should be changed to – acquire macroscopic images --.

Claim Objections

8. The previous claim objections have been withdrawn in light of Applicant's amendment.

Claim Rejections - 35 USC § 112

9. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

10. Regarding claim 31, the phrase "perferably" renders the claim indefinite because it is unclear whether the limitation(s) following the phrase are part of the claimed invention. See MPEP § 2173.05(d).

Claim Rejections - 35 USC § 101

11. The previous 101 rejections have been withdrawn in light of Applicant's amendment.

Claim Rejections - 35 USC § 103

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

13. Claims 3, 5, 8, 11, 13, 15, 27, 28 and 34 rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Shibata et al. (US 2002/0089664) and Park (US 6,432,800).

Regarding **claims 27 and 28**, Shibata discloses a method for analyzing a patterned semiconductor wafer wherein a specific number of dice are exposed with one "stepper area window" using an identical mask to expose the patterned semiconductor wafer with a plurality of SAWs, comprising the steps of:

dividing the SAW into a plurality of logical SAW segments ("die can be divided into a plurality of segments" at paragraph 0039, line 4),

initializing in a learning phase the image field of the image sensor ("region to acquire and image for conditioning...is selected on the display of the operating computer" at paragraph 0036, line 11; figure 5, numeral 35, which is equivalent to applicant's apparatus for selecting the image fields), wherein the image field of the image sensor is divided by way of an interactive control system (figure 5, numeral 35) into a plurality of SAW image field segments ("detected image is divided into regions of a predetermined size" at paragraph 0044, line 2; figure 11) in such a way that after a definable interval of acquired images, a repetition of an identical allocation (after obtaining the initial segmentation, the same allocation can be applied for the remainder of the wafer since "a similar pattern is formed in every die" at paragraph 0032, line 2) of imaged SAW segments ("die can be divided into a plurality of segments" at paragraph 0039, line 4) in image field segments occurs ("image region that is acquired for conditioning" at paragraph 0039, line 1 will contain the aforementioned SAW segments);

allocating the logical SAW segments to image field segments ("image region that is acquired for conditioning" at paragraph 0039, line 1 will contain the aforementioned SAW segments) in such way that an identical allocation of logical SAW segments to image field segments occurs at a definable travel interval and image interval (after obtaining the initial segmentation, the same allocation can be applied for the remainder of the wafer since "a similar pattern is formed in every die" at paragraph 0032, line 2);

an image sensor ("image sensor" at paragraph 0023, line 4; figure 5, numeral 154) to acquire a plurality of images of the at least one wafer ("obtaining a plurality of images" at paragraph 0007, line 2) wherein the plurality of images cover the entire wafer ("surface of the wafer 1 is scanned in a field of view of an optical system" at paragraph 0037, line 5).

digitally storing the acquired images (figure 5, numeral 31); and

carrying out comparison operations in run phases ("comparing between images of adjacent chips or cells" at paragraph 0041, line 10) in which the image field segments of images that have an identical allocation of image field segments to imaged SAW segments are compared with one another and with a specific master ("reference digital signal" at paragraph 0041, line 12; "image for conditioning the transmission (detection) ratio" at paragraph 0036, line 11).

Shibata does not disclose that the image sensor is a camera and moving the camera with the image field relative to the wafer.

Park discloses a system in the same field of endeavor of wafer defect inspection ("inspecting flaws in semiconductor wafers" at col. 1, line 8) wherein Park teaches moving a camera with an image field relative to a wafer ("camera 11 with the light source 15 can be configured to linearly move" at col. 4, line 43; figure 3, numerals 11, 15, and 40; "camera 11 is a digital line scan camera" at col. 4, line 8).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the optical system of Shibata using the camera system taught

by Park as described above, "to effect the relative movement of the wafer" (Park at col. 4, line 44).

Regarding **claim 3**, Shibata discloses a method wherein the logical SAW segments are of identical size ("each of the segments includes regions that correspond to every pattern width and pattern density to be observed in the die" at paragraph 0039, line 5, especially since each die on the wafer is identical).

Regarding **claim 5**, Shibata discloses a method wherein a comparison of physically adjacent image field segments is performed ("comparing between images of adjacent chips or cells" at paragraph 0041, line 10).

Regarding **claim 8**, Park discloses a method wherein a line camera is used to acquire microscopic images ("camera 11 is a digital line scan camera. Because the length of defects on the circumference 1 is normally less than 0.5 mm, high resolution image capturing is required" at col. 4, line 8).

Regarding **claim 11**, Park discloses a method wherein a relative motion of the wafer with respect to the camera occurs ("camera 11 with the light source 15 can be configured to linearly move" at col. 4, line 43).

Regarding **claim 13**, Shibata discloses an apparatus for an analysis of surface images of at least one wafer, wherein the at least one wafer has features that are generated using a stepper area window, the apparatus comprising:

an image sensor ("image sensor" at paragraph 0023, line 4; figure 5, numeral 154) to acquire a plurality of images of the at least one wafer ("obtaining a plurality of images" at paragraph 0007, line 2), wherein the image sensor defines an image field

("field of view of an optical system 15" at paragraph 0023, line 2) and a relative motion of the wafer with respect to the image sensor occurs ("Z-stage 10, a θ-stage 11, an X-stage 12 and a Y-stage 13" at paragraph 0022, line 3; "wafer 1 is scanned in a field of view of an optical system 15" at paragraph 0023, line 2);

a memory region in which the plurality of images of the wafer, acquired with the image sensor, are storable ("data server" at paragraph 0023, line 8; figure 5, numeral 31; "delay memory" at paragraph 0041, line 9; figure 9, numeral 62);

means for initializing in a learning phase the image field of the image sensor ("region to acquire and image for conditioning...is selected on the display of the operating computer" at paragraph 0036, line 11; figure 5, numeral 35, which is equivalent to applicant's apparatus for selecting the image fields), wherein the image field of the image sensor is divided into SAW-segment-imaging image field segments ("detected image is divided into regions of a predetermined size" at paragraph 0044, line 2; figure 11) in such a way that after a definable interval of acquired images, a repetition of an identical allocation (after obtaining the initial segmentation, the same allocation can be applied for the remainder of the wafer since "a similar pattern is formed in every die" at paragraph 0032, line 2) of imaged SAW segments ("die can be divided into a plurality of segments" at paragraph 0039, line 4) in image field segments occurs ("image region that is acquired for conditioning" at paragraph 0039, line 1 will contain the aforementioned SAW segments); and

a processing unit ("image processing section" at paragraph 0041, line 1; figure 9, numeral 30) for carrying out comparison operations ("comparing between images of

adjacent chips or cells" at paragraph 0041, line 10) in such a way that in, the image field segments of images that have an identical allocation of image field segments to imaged SAW segments are compared with one another or with a specific master ("reference digital signal" at paragraph 0041, line 12).

Regarding **claim 15**, Shibata discloses an apparatus wherein the processing unit compares only physically adjacent image field segments with one another ("comparing between images of adjacent chips or cells" at paragraph 0041, line 10) on the basis of a metric (in this case, the next segment).

Regarding **claim 34**, Park discloses a method wherein a relative motion of the wafer with respect to the camera occurs ("camera 11 with the light source 15 can be configured to linearly move" at col. 4, line 43).

14. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Shibata and Park as applied to claim 27, and further in view of Kuwabara (US 6,643,394).

Shibata and Park teach the elements of claim 27 as described in the 103 rejection above.

The Shibata and Park combination does not teach a method wherein the logical SAW segments and the image field segments are each indexed, and are allocated to the image field segments a combination of SAW segment index and image field index, on the basis of which a determination is made of the image field segments to be

compared, those image field segments which have an identical combination of SAW segment index and image field segment index being compared with each other.

Kuwabara discloses a method and apparatus in the same field of endeavor of wafer defect inspection wherein the dies on a wafer are separated into scanning areas (figures 4 and 5; the image field is defined by the scanning width and each chip is divided into segments) and subsequently indexed (""Sm-n" (m, n=1, 2, . . .)" at col. 5, line 41; figure 5).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the initialization means of Shibata and Park using the indexing taught by Kuwabara as described above, to enable comparisons between a segment and two similar segments to improve the likelihood of detecting any defects.

15. Claims 6, 12, 16 and are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Shibata and Park as applied to claim 11 above, and further in view of Yonezawa (US 6,222,624).

Regarding **claims 6 and 16,** Shibata and Park teach the elements of claims 13 and 27 as described in the 103 rejection above.

The Shibata and Park combination do not teach a method and apparatus wherein offsets of the SAW are learned during initializing and are taken into account in determining the allocation.

Yonezawa discloses a method and apparatus in the same field of endeavor of wafer defect inspection ("apparatus and...method for inspecting a defect on the surface

of an object to be inspected, such as a semiconductor wafer" at col. 1, line 6) wherein offsets of a SAW are taken into account during image comparison ("the wafer is offset by a one-chip portion" at col. 7, line 63; figures 2a and 2c).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the initialization means of Shibata and Park using the positional correlation taught by Yonezawa as described above, to effectively image the wafer such that corresponding patterns can be compared.

Regarding **claim 12**, Shibata and Park teach the elements of claim 11 as described in the 103 rejection above.

The Shibata and Park combination do not teach a method wherein an image is acquired by way of a flash that is triggered, with a diaphragm open, as a function of the relative position of the wafer.

Yonezawa discloses a method wherein an image is acquired ("image data from the CCD camera 21 is fetched into the image processor" at col. 7, line 52) by way of a flash that is triggered ("turns on the illuminant 2 to illuminate the wafer" at col. 7, line 49; "Subsequently, the controller 33 turns off the illuminant 2" at col. 7, line 56), with the diaphragm open ("diaphragm" at col. 6., line 60; figure 1, numeral 23), as a function of the relative position of the wafer ("controller 33 moves the X-Y stage" at col. 7, line 63; "Subsequently, images of the wafer 8 illuminated by the illuminants 2 and 11 are respectively picked up by the CCD camera" at col. 8, line 2).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the optical system of Shibata and Park using the flash and

diaphragm taught by Yonezawa as described above, to eliminate image smearing that may occur in the case that an area camera is used.

16. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Shibata and Park as applied to claim 27 above, and further in view of Bishop et al. (US 5,119,434).

Shibata and Park teach the elements of claim 27 as described in the 103 rejections above.

The Shibata and Park combination does not teach a method and apparatus wherein at least one region that is invalid and that is blanked out upon comparison of the image field segments can be defined within the SAW or an imaged SAW segment, in which context the validity can depend on the position of the SAW on a wafer.

Bishop discloses a system in the same field of endeavor of wafer inspection ("system block diagrams of FIGS. 15 and 16, useful for wafer and similar inspection" at col. 8, line 57) wherein at least one region that is invalid and that is blanked out upon comparison of the image field segments ("If a "Don't Care" coordinate is intercepted, it is marked as an invalid region and no defects will be flagged in these regions" at col. 3, line 60; figure 15, numeral H).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the comparison operations of Shibata and Park using the region blanking taught by Bishop as described above, to ensure that unnecessary comparisons are not made.

17. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Shibata and Park as applied to claim 27 above, and further in view of Park.

Shibata and Park teach the elements of claim 27 as described in the 103 rejection above.

The Shibata and Park combination does not teach illuminating a wafer with a continuous light source.

Park also teaches illuminating the wafer with a continuous light source ("A three phase fluorescent bulb is advantageously used as the lamp" at col. 4, line 19; since "the camera is configured to continuously capture the images" at col. 1, line 45, illumination is continuous as well).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the optical system of Shibata and Park using the light source taught by Park as described above, to enable the camera to produce images that are beneficial to determining the existence of defects on the wafers.

18. Claims 10, 29 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Shibata and Park as applied to claim 27 above, and further in view of Lin et al. (US 6,292,260).

Shibata and Park teach the elements of claim 27 as described in the 103 rejection.

The Shibata and Park combination does not teach a method wherein an area camera is used, which can acquire microscopic or macroscopic images.

Lin discloses a method in the same field of endeavor of wafer defect inspection ("system and method of optically inspecting photoresist structures on the surface of semiconductor wafer dice" at col. 5, line 37) wherein an area camera is used ("area-scan camera" at col. 6, line 13; figure 2, numeral 120), which can acquire microscopic or macroscopic images (images acquired by the camera are either microscopic of macroscopic; furthermore, the area camera may or may not be used in conjunction with a microscope system as "Optical arrangement 122 may, for example, comprise a lens system and be part of a microscope" at col. 6, line 15).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the optical system of Shibata and Park using the camera taught by Lin as described above, to be able to contain more wafer area in each image and subsequently accommodate a bigger range of SAW sizes.

19. Claims 14 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Shibata and Park as applied to claim 13 above, and further in view of Kuwabara and Ramakrishna et al. ("File Organization...", ACM Transactions on Database Systems).

Shibata and Park teach the elements of claim 13 as described in the 103 rejection above.

The Shibata and Park combination does not teach a method and apparatus wherein the memory region is managed, by means of an array and a hash function, in such a way that the imaged SAW segments and the image field segments are each indexed, and there is allocated to the image field segments a combination of SAW segment index and image field index, on the basis of which a determination is made of the image field segments to be compared, those image field segments which have an identical combination of SAW segment index and image field segment index being compared with each other.

Kuwabara teaches the elements of claims 4 and 20 as described in the 103 rejection above, which correspond to the indexing requirements of claim 14.

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the initialization means of Shibata and Park using the indexing taught by Kuwabara as described above, to enable comparisons between a segment and two similar segments to improve the likelihood of detecting any defects.

The Shibata, Park and Kuwabara combination does not teach a method and apparatus wherein the memory region is managed, by means of an array and a hash function.

Ramakrishna discloses a method wherein a memory region is managed by means of an array and hash function ("file organization based on perfect hashing" at section 1, paragraph 2, line 2; accordingly, the hash table involved is an array).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to manage the memory region of Shibata, Park and Kuwabara using the file organization taught by Ramakrishna as described above, so that "any record can be retrieved in a single disk access" (Ramakrishna at section 1, paragraph 2, line 3), thereby allowing for a more efficient file access.

20. Claims 30 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Shibata and Park as applied to claim 27 above, and further in view of common knowledge in the art as evidenced by Addlego (US 5,917,588).

The Shibata and Park combination discloses a line camera ("camera 11 is a digital line scan camera" at col. 4, line 8) and that the wafer is illuminated with a continuous light source ("A three phase fluorescent bulb is advantageously used as the lamp" at col. 4, line 19; since "the camera is configured to continuously capture the images" at col. 1, line 45, illumination is continuous as well).

The Shibata and Park combination does not disclose that the line camera can acquire macroscopic images.

However, it is common knowledge in the art to conduct a macro level inspection of the semiconductor wafer to find large defects and that line cameras can be used to conduct such inspection (Addlego at figure 2A, numerals 80 and 82; "Macro inspection system" at col. 3, line 13).

Response to Arguments

21. Applicant's arguments filed on June 05, 2007 have been fully considered but they are not persuasive. Regarding Applicant's arguments with respect to the prior art, the above modified rejections and rejections of the new claims address the issues at hand.

Summary of Remarks (@ response page 11): The Shibata reference does not disclose "initializing in a learning phase an image field of a camera".

Examiner's Response: Disagreed. As the examiner pointed out in the rejection,

> "initializing in a learning phase the image field of the image sensor ("region to acquire and image for conditioning...is selected on the display of the operating computer" at paragraph 0036, line 11; figure 5, numeral 35, which is equivalent to applicant's apparatus for selecting the image fields)"

Specifically, there is a conditioning phase in which the image field is set by establishing the region to be captured.

Summary of Remarks (@ response page 11): The Shibata reference does not disclose "allocation of logical SAW segments to image field segments occurs at a definable travel interval and image interval".

Examiner's Response: Disagreed. See the above modified rejection of claims 27 and 28.

Summary of Remarks (@ response page 11): The Shibata reference does not disclose that "the plurality of images cover the entire wafer".

Examiner's Response: Disagreed. See the above modified rejection of claims 27 and 28.

Summary of Remarks (@ response page 12): The Park reference does not disclose "as the camera travels over the wafer an identical allocation of logical SAW segments to image field segments".

Examiner's Response: The Park reference was relied upon as a teaching for moving a camera over a wafer as a way to establish relative movement of the wafer with respect to the camera. The allocation is done on the part of the Shibata reference as stated in the rejection above.

Conclusion

22. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. US 5,864,394, US 20020027653, US 20030133604, and US 20020172411 are each pertinent as teaching image-based wafer inspection systems.

23. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Katrina Fujita whose telephone number is (571) 270-1574. The examiner can normally be reached on M-Th 8-5:30pm, F 8-4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vikkram Bali can be reached on (571) 272-7415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

KF

Katrina Fujita
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